

## Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.



# Foreign AGRICULTURE

REVIEW OF FOREIGN FARM POLICY, PRODUCTION, AND TRADE

*Secretary*

## IN THIS ISSUE

CHINA'S FOOD PROBLEM

AGRICULTURE AND FOOD IN DENMARK

## C O N T E N T S

	Page
CHINA'S FOOD PROBLEM . . . . .	99
Estimated pre-war food supplies and consumption . . . . .	99
The wartime food-supply situation in China . . . . .	102
Immediate post-war food requirements . . . . .	104
Wheat . . . . .	104
Rice . . . . .	104
Supplemental foods . . . . .	105
Vitamin needs . . . . .	106
Difficulties in food-supply distribution . . . . .	106
The problem of improving national nutrition . . . . .	108
AGRICULTURE AND FOOD IN DENMARK . . . . .	110
Denmark's agriculture and food economy prior to World War II . . . . .	110
Introduction . . . . .	110
Crop production . . . . .	110
Utilization of crops . . . . .	111
Feed . . . . .	111
Human consumption . . . . .	112
Livestock numbers . . . . .	114
Livestock products . . . . .	115
Agricultural developments since the outbreak of war . . . . .	117
Introduction . . . . .	117
Acreage, yield, and production . . . . .	118
Areas . . . . .	118
Yields and production . . . . .	118
Livestock numbers and production of animal foodstuffs . . . . .	119
Food supplies . . . . .	120

# CHINA'S FOOD PROBLEM . . . .

By Owen L. Dawson\*

*The traditional uncertainties surrounding food production and distribution in China have become acute under war conditions, particularly in Occupied China, where normally less food is produced than consumed. In Free China as a whole, production now exceeds the requirements needed to meet the low pre-war level of consumption, but the accessible domestic supplies have not been sufficient to meet all wartime requirements. Proteins, vitamins, and mineral-bearing foods are particularly scarce. Occupied China also needs these elements, in addition to substantial quantities of numerous basic-food items. Details of this situation are presented and discussed to show the relation of the food problem to the war effort and the post-war reconstruction period.*

## ESTIMATED PRE-WAR FOOD SUPPLIES AND CONSUMPTION<sup>1</sup>

Great deficiencies in the production and consumption data make it difficult to arrive at acceptable figures for the pre-war average consumption of foodstuffs in China. The figures given in this article, therefore, are to be considered only as the best estimates possible at this time.<sup>2</sup> According to these estimates, the average annual amount of all foodstuff items available for consumption, during this period, totaled about 179 million short tons. This is the equivalent of a per capita consumption of 842 pounds, based on an estimated population of 425 million persons (table 2).

Of this 179,000,000 tons, imported materials amounted to only about 1,900,000. Average imports of wheat, and of flour in terms of wheat, during the years 1933 to 1937, were about 595,000 short tons annually, the flour fraction comprising 20 percent. Rice imports during the same period averaged about 992,000 short tons, in terms of cleaned rice; and imports from Manchuria of soybeans and of soybean oil in terms of soybeans totaled about 331,000. Small quantities of other foodstuffs, such as sugar, fruits, meat, and dairy products, were also brought into the country. At the same time, China exported certain food products, principally peanuts, eggs, tea, sesame seed, other oilseed products, and animal products.

Taking separately what are now referred to as Free and Occupied China,<sup>3</sup> food supplies estimated to be available for Free China averaged 96,700,000 short tons in the years indicated. No figures are available to show what was exported from Free China during that time, but large amounts of rice and other crops are known, under normal conditions, to have moved from Free to what is now Occupied China. These are

\* Foreign Service Officer, formerly in Shanghai, on detail to the Department of Agriculture.

<sup>1</sup> China, excluding Manchuria.

<sup>2</sup> For sources and methods of calculation see footnotes to tables 1, 2, and 3.

<sup>3</sup> The border line between these two zones is not strictly drawn. In this study, Free China is taken to comprise Sinkiang, Sikang, Ninghsia, Tsinghai, Kansu, Shensi, Honan (excluding 64 hsien), Hupeh (excluding 39 hsien), Szechwan, Yunnan, Kweichow, Hunan, Kiangsi, Chekiang (excluding 21 hsien), Fukien, Kwangtung (without the Canton area), and Kwangsi. Occupied China is taken to comprise Kiangsu, Anhwei, Shantung, Hopei, Shansi, Chahar, eastern Suiyuan, parts of Honan and Hupeh, Chekiang, and that part of Kwangtung surrounding Canton.

TABLE 1.—Average pre-war production of the principal crops in all China and in Free China

CROPS	ALL CHINA <sup>1</sup>	FREE CHINA <sup>2</sup>		CROPS	ALL CHINA <sup>1</sup>	FREE CHINA <sup>2</sup>	
		QUANTITY	PERCENTAGE OF ALL CHINA			QUANTITY	PERCENTAGE OF ALL CHINA
Summer Crops		1,000 sh.tons	1,000 sh.tons	Percent		1,000 sh.tons	1,000 sh.tons
Rice . . . . .	55,436	43,493	78	Winter Crops	Wheat . . . . .	23,842	9,323
Kaoliang . . . . .	7,751	1,792	23	Barley . . . . .	8,602	4,605	54
Millet . . . . .	7,402	1,386	19	Field peas . . .	3,490	2,276	65
Proso millet . . . . .	1,720	555	32	Broadbeans . . .	3,310	2,432	73
Corn . . . . .	7,136	3,281	46	Rapeseed . . . . .	2,687	2,020	75
Soybeans . . . . .	6,744	2,178	32	Oats . . . . .	952	163	17
Sweetpotatoes . . . . .	19,802	11,908	60				
Cotton . . . . .	3,724	215	30				
Peanuts . . . . .	3,039	1,100	36				
Sesame . . . . .	962	381	40				
Tobacco . . . . .	711	511	72				
Total	111,427	66,800	60		42,883	20,819	49

<sup>1</sup> Data are for 22 Provinces of China, compiled, except for cotton, from NATIONAL AGRICULTURAL RESEARCH BUREAU, CROP REPORTS, Nanking, for the following periods: 1931-37 for wheat, barley, and rapeseed; 1933-37 for field peas, broadbeans, and oats; 1933-36 for peanuts, sesame, and tobacco; and 1931-36 for all others, except cotton.

<sup>2</sup> Averages of 1931-37 for the 15 Provinces now comprising Free China. From photostatic copies of data from the NATIONAL AGRICULTURAL RESEARCH BUREAU, Chungking, received in Washington, February 10, 1943.

<sup>3</sup> Average production during 1932-36 in 22 Provinces of China. Data taken from DAWSON, OWEN L., CHINA COTTON REVIEW 1936-37 AND OUTLOOK FOR 1937-38, Shanghai, August 8, 1937. [Type-written.] Manchurian data, which were subtracted from totals in the above publication, were taken from DAWSON, OWEN L., COTTON SITUATION IN CHINA INCLUDING MANCHURIA REVIEW OF 1940-41 AND OUTLOOK FOR 1941-42, Shanghai, August 8, 1941. [Type-written.]

estimated at 3,300,000 short tons, which would leave for consumption in Free China 93,400,000 tons, or 853 pounds per capita. There would remain for Occupied China 85,600,000 short tons, or an estimated per capita supply of 831 pounds. (See table 2.)

The diet of China taken as a whole, according to a study made in 1934 by the National Agricultural Research Bureau, included cereals in the following percentages of the total diet: Rice, 28 percent; millet of all types, 18; wheat, 16; corn, 8; barley, 6; and kaoliang, 5 percent. Cereals thus made up a total of 81 percent by weight.<sup>4</sup>

Soil and climatic conditions, together with inherited cropping systems and traditional dietary habits, however, have caused a wide diversity in the cereal and supplementary crops that are grown in different parts of China. The pre-war consumption pattern, furthermore, was closely tied to production areas, since the trade between parts of China was relatively small in comparison with the total amounts produced and consumed. For example, only about 20 percent of the Central China rice moved into commerce, and perhaps only about a third of that was shipped more than 200 or 300 miles. Among the Provinces, therefore, there was considerable variation in the diet.

Distinctive features in the general pre-war diet existed in the principal divisions of China — North, Central, South, and West China. In North China a great diversity of grains was consumed, with wheat the chief cereal and rice unimportant. In Central China both wheat and rice were consumed in large quantities, numbers of the people using these two foodstuffs interchangeably. South China was a heavy rice-consuming area; but the sweetpotato, the principal staple of the poorer population, formed an important supplement. West China had a more varied diet, made up of rice mixed with other cereals, in general similar to that of Central China.

<sup>4</sup> Of the staple crops reported, fruits, vegetables, sugar, and meats were omitted.

TABLE 2.—Estimated available quantities of foodstuffs, on basis of agricultural product, in specified parts of China, pre-war averages<sup>1</sup>

ITEM	ALL CHINA <sup>2</sup> Million sh. tons	FREE CHINA <sup>3</sup> Million sh. tons	OCCUPIED CHINA <sup>3</sup> Million sh. tons	ITEM	ALL CHINA <sup>2</sup> Million sh. tons	FREE CHINA <sup>3</sup> Million sh. tons	OCCUPIED CHINA <sup>3</sup> Million sh. tons
Cereals . . . . .	102.8	58.6	44.2	Unreported <sup>6</sup> . . . . .	8.5	4.6	3.9
Legumes . . . . .	14.7	7.0	7.7	Total . . . . .	177.1	96.7	80.4
Vegetables, except potatoes . . . . . <sup>4</sup>	19.6	9.5	10.1	Foreign Imports (net)	1.9	—	1.9
Supplementary crops <sup>5</sup>	22.6	12.3	10.3	Total . . . . . <sup>7</sup>	179.0	96.7	82.3
Meat, fish, and eggs	4.4	2.4	2.0	Domestic shipment . . .	—	-3.3	+3.3
Fruit . . . . .	2.5	1.3	1.2	Total available . . .	179.0	93.4	85.6
Miscellaneous . . .	2.0	1.0	1.0	Per Capita (in pounds) <sup>8</sup>	842	853	831

<sup>1</sup> In general, between the years 1931 and 1937, although the years averaged differ with different commodities, depending on the data available.

<sup>2</sup> The figures for cereals, legumes, and supplementary crops represent average production as shown in table 1, less 10 percent for feed, seed, and waste. They also include the following quantities not shown in table 1 (in 1,000 short tons): Buckwheat - 1,196; green beans - 1,587; black beans - 1,446; and Irish potatoes - 2,202, but they do not include amounts imported.

Figures for vegetables (other than potatoes), for fruits, and for vegetable oils are calculated from data of J. L. BUCK, LAND UTILIZATION IN CHINA, 1937, which give the percentages of the calories in the total diet that are supplied by these items. The figure for sugar represents domestic consumption plus imports from abroad. The figure for tea follows data for tea consumption given by NATIONAL AGRICULTURAL RESEARCH BUREAU, CROP REPORTS, Nanking, October 1, 1934; and figures for butter, coffee, and cocoa represent average imports of these commodities.

<sup>3</sup> The percentages of total production assigned to Free China and to Occupied China, for cereals, legumes, sweetpotatoes, and peanuts, have been determined by dividing the estimates of total production for all of China into the production of the same commodities for Free China (see table 1). For most of the remaining commodities, a division was made on the basis of the relative amounts consumed in each of these parts of China, as calculated from consumption data by Provinces given by NATIONAL AGRICULTURAL RESEARCH BUREAU, CROP REPORTS, October 15, 1938.

<sup>4</sup> Potatoes, sweetpotatoes, and peanuts.

<sup>5</sup> Sugar, vegetable oils, milk, butter, tea, coffee, and cocoa.

<sup>6</sup> Estimated at 5 percent of reported products.

<sup>7</sup> Estimated movement from Free to Occupied China.

<sup>8</sup> Based on a population for All China of 428 million; for Free China, 219 million, and for Occupied China, 208 million.

While North China is more subject to famine, in normal years the diet of this part of China was more varied, and the deficiency of vitamin B<sub>1</sub> was much less than in South China. Wheat, varied by millet, kaoliang, and corn, furnished a more protective ration than the heavy rice diet of the south. Soybeans and peanuts were also more widely consumed than in the south. Calcium deficiency, however, was more prevalent in North China, in part owing to the difficulty of getting as much sunshine as in South China. With more sunshine, the deficiency in vitamin D would be partly made up, and this in turn would correct to some extent the present faulty metabolism of calcium.

Another reason for this deficiency in calcium was a dearth of vegetables at certain times of the year. Fruit and vegetable production of all China was much too localized and seasonal; and these products, therefore, formed far too small a proportion of the diet for the mass of the population.

Meat and egg consumption in China was notably small also, although egg production was rather widespread, and although production was large in areas where export industries had been built up. Of the meats, more pork was consumed than any other type, but beef, mutton, and chickens were also widely used for food, although in small quantities on the average. Relatively large amounts of meat were often eaten by the well-to-do Chinese, but the poor man could afford only meager amounts, which he considered more in the category of a luxury for special occasions.

~~~

On the basis of pre-war statistics, a greater diversification of production, through some shifting of crops where climatically possible, would have partially solved the diet-improvement problem for the rural population, had there been no war. A better distribution of products from areas where they were produced to advantage might have been of almost equal importance. Improved transportation and storage facilities were and still are of particular importance in order to make use of domestic products in improving the diet in the cities.

### THE WARTIME FOOD-SUPPLY SITUATION IN CHINA<sup>5</sup>

Since the outbreak of war between China and Japan in 1937, China's output of foodstuffs has fluctuated considerably. In general, crops have been somewhat better in Free China than in Occupied China. Serious local shortages have existed in several areas, but Free China as a whole now produces a tonnage of cereals that is more than equivalent to its needs. It lacks acutely, however, certain foods, some of which were imported before the war, and which now are in even greater demand, owing to the special requirements of the army and of civilians taking part in the war effort.

Conditions are less favorable in Occupied China, where there has been an unusual series of floods and droughts. The situation has been made worse there by the virtual stoppage of imports and by Japanese requisitions. Also, military activity has stopped a large part of the movement of foodstuffs that normally passed from Free China to the presently occupied areas. Consequently, Occupied China has been suffering a heavy decline in per capita food consumption.

The chief needs of China at present, based on the pre-war levels of consumption, are for cereals and small amounts of protective foods. For Free China, the chief import needs will be for protective foods, particularly if legume crops again fall below average as they did the past season. In general, the deficiencies are greatest where fighting has recently occurred, in areas of crop failure, and in coastal centers of population.

Based on crops reported and unreported, with allowance made for 2,200,000 short tons of exports to Occupied China, and assuming no change in stocks, the supply of food available for consumption in Free China during the 1942-43 crop season is put at 90,400,000 short tons. This indicates a per capita consumption of 826 pounds. Since, according to reports, an important increase in rice stocks occurred in 1939 and 1940, the short crop of 1942 probably induced some liquidation of these stocks. In this case the per capita figure for the past season would be increased somewhat.

Based on the above-mentioned suppositions regarding imports from Free China, and allowing for a decrease in total production in Occupied China of some 7 percent, compared with pre-war, there probably remained available in Occupied China for the 1942-43 crop year about 75,700,000 short tons. This would provide an average per capita consumption of only 735 pounds, compared with the pre-war figure of 831 pounds.

This analysis indicates a total deficit in Occupied China for the season 1942-43 of 9,800,000 short tons of cereals and supplemental crops, compared with consumption on the pre-war level. If crops for the season 1943-44 should be about average, which is doubtful, the deficit would be reduced to about 5,500,000 short tons. Some 2,200,000 tons of cereals will be available from stocks in Free China for use in Occupied China, when the latter becomes accessible, provided they can be acquired for such use. Further amounts may also be available later from Japan's accumulated stocks,

<sup>5</sup> Excluding Manchuria

~~~

but this also is doubtful. The needs for cereals and supplemental crops that remain will have to be met by imports from southeast Asia and other countries.<sup>6</sup>

According to recent revised crop estimates, the National Government has had little success in its efforts to increase the total crop output in Free China. For the major crops, production during 1942 fell 5 percent below the average of 1931-37, assuming that the averages are as fully covered as those of 1942-43. (For a comparison between the production of principal crops during recent years and their average production during the period 1931-37, see table 3.)

TABLE 3.—Production of specified crops in Free China, average 1931-37, annual 1940-43

CROPS	AVERAGE 1931-37	1940	1941	1942	1943
	1,000 sh.tons	1,000 sh.tons	1,000 sh.tons	1,000 sh.tons	1,000 sh.tons
Cereals					
Wheat . . . . .	9,323	11,084	9,101	10,899	10,589
Barley . . . . .	4,605	4,731	4,067	4,925	4,511
Oats . . . . .	163	168	159	171	—
Rice . . . . .	40,031	34,109	35,468	35,010	37,335
Rice, glutinous . . . . .	3,462	2,389	2,240	2,329	—
Kaoliang . . . . .	1,792	1,723	1,635	1,325	1,630
Millet . . . . .	1,386	1,167	1,141	814	1,283
Proso millet . . . . .	555	476	557	533	—
Corn . . . . .	3,281	3,695	3,667	3,224	3,764
Total . . . . .	64,598	59,542	58,035	59,230	—
Supplementary Crops					
Field peas . . . . .	2,276	2,373	2,069	2,327	—
Broadbeans . . . . .	2,432	2,630	2,310	2,624	—
Soybeans . . . . .	2,178	2,126	1,913	1,621	1,935
Sweetpotatoes . . . . .	11,908	14,132	15,272	13,371	15,460
Supplementary total . . . . .	18,794	21,261	21,564	19,943	—
Total above . . . . .	83,392	80,803	79,599	79,173	—
Used for food <sup>1</sup> . . . . .	75,053	72,723	71,639	71,256	—
Oil Crops					
Peanuts . . . . .	1,100	1,257	1,259	1,218	—
Sesame . . . . .	381	453	405	345	—
Rapeseed . . . . .	2,020	2,675	2,515	2,433	—
Total . . . . .	3,501	4,385	4,179	3,996	—
Industrial Crops					
Tobacco . . . . .	511	566	469	453	—
Cotton . . . . .	266	335	297	329	—
Grand total . . . . .	87,670	86,089	84,544	83,951	—

<sup>1</sup> Deduction of 10 percent for seed, feed, etc.

Compiled by the Office of Foreign Agricultural Relations, from photostatic copies of Chungking Agricultural Research Bureau, Crop Reports, received in Washington, February 10, 1943, and preliminary estimates, received in Washington from Chungking, October 8, 1943.

The hope is that government encouragement will result in increased production of summer crops in 1944 and a corresponding increase in foods. Likewise the planting of vegetables might well be increased in order to obtain a higher production of needed food per unit of acreage around centers where it is most required.

Since the deficit situation is far worse in Occupied than in Free China, when the war progresses to enemy-held territory the need for foodstuffs and for production facilities in China will become greater than at present. Also, the tendency to feed the army from the sections in which it is stationed, owing to difficulties of transportation, makes a heavy drain on those sections. During the present and the succeeding

<sup>6</sup> These estimates of requirements are based on the low pre-war levels of consumption. They would have to be materially increased if provisions for an adequate diet were planned.

~~~

crop year this practice is expected to affect large numbers of the rural population, and extensive districts may be so depleted that production of foodstuffs for the following years will be seriously affected. When they are finally liberated from Japanese control, the need for imported food will continue at least until one or two harvests have been gathered.

### IMMEDIATE POST-WAR FOOD REQUIREMENTS

The products required to meet the immediate post-war requirements of those parts of China affected by the war can be provided out of supplies that are most readily available from South Asia and North America, or from Australia and New Zealand, depending upon which lines of communication to sources of surplus cereals are first opened. Such products as vitamin concentrates and the sources of important vitamins may be available in limited quantities from the United States, but every attempt should be made to utilize natural sources in China itself through processing and preservation. This requires more study and research in China and the aid of qualified specialists.

There are at the present time among the United Nations large surpluses of wheat, but rice supplies are limited. The principal regions of the world that produce a surplus of rice are now under Japanese control. About 85 percent of all the surplus originates in three countries alone, namely, Thailand, Indochina, and Burma. The probability is, however, that this surplus rice from southern Asia will be available to China as soon as wheat or flour can be shipped there in volume from other parts of the world.

Furthermore, when such shipments become possible, there may exist in China about as much need for wheat as for rice. Rice is in demand in parts of Free China, which as a whole is self-sufficient in cereals if the rice that it produces can be collected and distributed where needed. And parts of Occupied China, which consume both wheat and rice, will probably be open to foreign imports at about the same time as Free China.

A number of questions with reference to each of the major types of foodstuffs needed will, however, require consideration. Some of these may need decision shortly, whereas others cannot be taken up until after the war.

#### Wheat

An important factor to be taken into account, with regard to wheat, is the necessity for supplying it in a form that can be stored, transported, and moved into consumption with as little waste as possible of its nutritive value. In the past, 20 percent of the wheat imported has usually been in the form of flour. The form in which to supply wheat in this case, of course, will be determined by the special requirements of the situation at the time shipments can be made in volume into China.

In order to determine which can be used to better advantage, wheat or wheat products, a knowledge of the storage, distribution, and milling facilities in Occupied China is important. It is also important to know in what form the different groups to be fed are accustomed to consume their wheat. If the people are to be fed in groups, for which the cooking and baking can be controlled, the problem is not especially difficult.

#### Rice

Since, in China, rice is the food item consumed in greatest volume, the importance of conserving its food value during the war period and for post-war relief

~~~

purposes cannot be overestimated. The most efficient use of rice in China depends upon a proper storage of the cereal in its paddy form, and upon the establishment of milling facilities at important centers. If rice is partially milled, most of the vitamin B<sub>1</sub> is saved, but it must be used soon after milling if the full caloric value is to be utilized. If partially milled rice is stored for a long time, it rapidly loses vitamin B<sub>1</sub> and other nutritive elements.

Parboiled rice, which is already used in parts of China, and which has proved successful in other countries, may have possibilities worth expanding for China as a whole. The value of parboiling lies in the retention which it secures of a higher percentage of fats, proteins, and vitamins. The main problem in expanding the use of this product would seem to be in the administration of plants and in accustoming the consumer to the product, which differs from ordinary white rice in appearance and taste.

Considerable differences have been found in the food values of various kinds of rice. To determine what varieties provide the best nutrition is important, particularly with respect to the protein content. In this the agriculturist can be of great aid to the nutritionist.

#### Supplemental Foods

The question of utilizing rice in the most efficient manner possible is on the way to solution, but matters with regard to the production of supplementary foods must be given attention. This is particularly important to keep in mind in planning for post-war programs. Evidence already shows that the percentage of cereals in the diet is too high, regardless of how well they may be utilized. Proteins in China, also, are notably deficient in quality, and increased requirement of animal proteins would be difficult to supply. Therefore, a post-war expansion of legume production, together with an improvement in quality, is essential.

Normally, about 331,000 short tons of soybeans have been imported to supplement the production of about 2 million short tons in China proper. Most of these imports came formerly from Manchuria, and they will not be available again until after the war. That soybeans are used in many varied forms in all parts of China is quite well known, but they are often too high in price for the most desired utilization. Since the promotion of improvements in the production and utilization of soybeans in China is important, a way should be found to import them at a low price from Manchuria, when beans from that source again become available. This could only be done by improving production methods and marketing conditions in Manchuria and by providing cheaper transportation to and within China. With a wider and better use of soybeans in China, where they are already known to most of the population, and by supplementing these with other legumes not now widely grown, many of the pronounced diet deficiencies can be overcome. Peanuts and certain other beans, which already are produced extensively in China, should also be expanded where possible.

With respect to livestock, which can be expanded only slightly, work is under way to improve the breeds and health of the different animals now raised in China. There is involved, also, the question of producing feed for the animals, especially if some of the cereal byproducts now fed to animals, such as rice bran and wheat bran, are consumed by people. Chickens probably offer the best prospect of increase without increasing proportionately the land on which to produce feed.

The demand for dairy products is growing, especially in the large centers, but an expansion sufficient to provide for a large part of the population will not be practicable. Much can be done, however, to produce dairy products in certain sections so that these foodstuffs will be available where most needed, especially for children.

### Vitamin Needs

The most important diet deficiencies in China result, in general, from the lack of a continuous supply of protective foods. Ready sources of vitamins B, A, D, and C are all needed. This applies even to Free China, where energy-producing foods as a whole are sufficient, but where it is important to find a means of supplying protective foods from domestic sources. For Occupied China a more abundant supply is needed both of cereals and of protective foods.

Vitamin A deficiency may be partially overcome by increasing the production of green and yellow vegetables. Such sources of this vitamin would be utilized to better advantage if the vitamin could be stabilized in the vegetable form in such a way that it could be transported considerable distances and stored.

Since a provision is desirable for supplying the normal deficiency of the vitamin B complex in Free China, during and after the war, the production of yeast might be studied to great advantage. Production of this product would go far in meeting the need for the vitamin B complex. The vitamin B problem will be at least partially solved if an important source of these vitamins — rice bran and polishings — can be more extensively used, but for this some kind of stabilization program would be required.

The deficiency of vitamin C is important in certain localities during off-seasons for vegetables, particularly in North China. Sources of vitamin C may be found in dried grasses or juices of grass and fruit. Grass, cut at a certain stage and dried promptly, has proved a potent source in the United States. The Missouri Experiment Station reports that persimmon leaves are a potential source. These and other leaves readily available in China might be studied. The importance of paprika and sesame as sources of vitamins A and C might justify increased production in China.

The deficiency of vitamin D, which is related to calcium deficiency, is important in North China. This deficiency is difficult to overcome from domestic sources. In some cases vitamin D might be supplied in the form of fish products or similarly well-known sources. For other reasons, also, an increase in the supply of fish for consumption in China is very important. Any fish products or fish oil that can be made available for shipment to China will be helpful in supplying much-needed nutritive elements, especially vitamins A and D, and iodine. They will also help to supply some of the deficiencies in proteins.

Among the fine fruits produced in various parts of China are oranges, pomeloes, lemons, bananas, figs, dates, and mangoes. Good Temperate Zone fruits, also, such as apples, pears, grapes, peaches, and persimmons, are grown in the central and northern parts of China. Difficulty may be experienced under present conditions in making the best use of China's fruit unless facilities can be improved for the drying of fruits or the dehydration of citrus juices. In any event, a greatly increased production and use of fruit should have an important part in future plans for agriculture.

The importance of vitamin concentrates is also recognized, particularly for clinical cases of nutritional deficiencies. Certain forms of such vitamin supplements should be made available for the treatment of acute cases of deficiency and, possibly, for limited use in other marked cases of nutritional deficiency that cannot readily be overcome by vitamins in food.

### DIFFICULTIES IN FOOD-SUPPLY DISTRIBUTION

The margin or surplus, over requirements, of important food products in Free China, as shown in crop reports, cannot be generally accepted as an indication of sufficiency in food products. The situation, also, is affected by difficulties of

transportation, collection, and distribution and by the prevalence of the practice of holding stocks, due to inflation. Under present war conditions in China, these factors make for much more difficulty in using to advantage the surplus products that are produced within the country.

Formerly, a rather frequent happening in China was that products were imported to coastal areas from foreign countries when, at the same time, surpluses existed far in the interior. The situation today is still more complicated, on account of the wartime disruption of road and railway facilities. Trucks that would otherwise be available are out of commission because of a lack of spare parts and fuel. Also, the usual directional flow from the interior toward the coast has been seriously interfered with, because of the occupation of many of the coastal areas by the Japanese. This occupation now gives to the Japanese a control of the principal railway lines of China. These lines may again serve a useful purpose when the war moves farther into Occupied China, if they have not been destroyed. Today this cannot be assumed.

In order to redirect the flow of surplus foodstuffs from points of production to areas of consumption in Free China, the construction of new lines of transportation has been necessary. A notable achievement existed in the construction of the Burma Road. A northwest route by which some supplies come into China has also been opened. The main problem in the distribution of food supplies, however, is transportation between the Provinces of West China and the Provinces of South, Central, and north-western China.

To meet this problem, some remarkable progress has been made in the development of motor roads that connect the Provinces of the west with those of the central and southern plains and with those of the northwest region. These roads and highways, however, are mainly between the principal cities of Free China, and their effectiveness is greatly limited by the shortage of trucks and motor fuel. The chief use of these roads, at present, is to facilitate the movement of human and animal carriers, the present mainstays of Free China's transportation system. With regard to the transporting of foodstuffs, with which we are mainly concerned, the system is inadequate for a quick distribution, should imported supplies become available in volume.

A further problem, connected with transportation difficulties, is that of collection and distribution. The lack of storage facilities in small towns and cities is well known. Moreover, the small proportion of the farmers' commercial crop that goes to distant markets further aggravates the need of local storage, since an inadequacy in this respect would presumably lead to huge losses resulting from waste owing to long delays in utilization. Obviously, the lack of transportation and the difficulties of distribution are so deeply interrelated that either one would explain the obstacles encountered in moving food supplies within China.

Beyond these problems of distributing food supplies is the one of hoarding by landlords. A good example is found in the Province of Szechwan, where a large proportion of the rice crop goes to the landlords. When rice was rapidly advancing in price, during the two seasons preceding 1941-42, there was an unusual incentive to hoard. A similar condition prevailed more or less in the other rice-producing Provinces of Free China. Since storage facilities are limited, however, the assumption now is that the net amount going into hoarding is not large. Nevertheless, stocks from earlier years must be fairly heavy. To what extent the Government will be able to make full use of this rice, and eventually to transport it to central storage places in Occupied China for later distribution, is now a question.

The Government has tried to meet the problem of hoarding and speculation by collecting the land tax in grain and by a compulsory purchase of foodstuffs. While

~~~

these measures have resulted in rather large collections, doubt still remains as to whether they have been fully adequate to meet the needs for group distribution.

The Government has also made some effort to distribute more equitably the burden of the land-tax collection by an improved system of land registration and appraisal. The collection of taxes in the present manner has shown favorable progress, and it has proved to be one of the most important methods of collecting essential foodstuffs to carry on the war.

The Chinese Ministry of Foods, in a review of the general food situation, dated October 19, 1942, indicated that its program for ensuring an adequate supply of food for the army and civil officials had proved to be generally satisfactory; but considerable difficulty continued in 1943, owing to lack of transportation facilities. Information received from Chungking indicates that during the past season certain parts of China were very short of food, in which difficulty was experienced in administering relief. The most serious of these conditions existed in the Province of Honan, where 9 million people were affected. The other Provinces affected were Kiangsi, Chekiang, Shensi, and the southern part of Kwangtung. Foreign-relief agencies assisted the Chinese Government in coping with the distress in these Provinces, but the relief they could provide was rather meager.

According to reports from Chungking as of November 1, 1943, famine conditions in Honan were not expected to be so serious as those of 1942, although severe privations still continued to exist in some sections. That part of Honan on the Yellow River, especially five or six districts near Chengchow, was the most seriously affected.

### THE PROBLEM OF IMPROVING NATIONAL NUTRITION

The foregoing brief survey of the food situation of China clearly shows that restoration of the pre-war food-consumption pattern will not correct the national nutritional deficiencies. A more adequate transportation system would help materially in the utilization of domestic supplies for the prevention of famine, but nutritional maladjustments exist even in many places where a crop surplus is produced. Pre-war surveys of rural China by Buck<sup>7</sup> and others, studies of factory workers' diets in Shanghai, and clinical observations in various places have indicated that important nutritional shortcomings accompanied the low pre-war level of food consumption. They are repeated here for the purpose of suggesting post-war means of improvement:

(1) A large part of the food comes from vegetable sources, including a very high percentage of cereals, which means that much bulk is required to secure the necessary food elements. (2) Energy-yielding foods are sufficient in usual crop years in most localities, but the diet is generally short of leafy vegetables, fruits, certain roots, and important protective foods, such as dairy products, eggs, and so forth. (3) Deficiencies in calcium are quite general, especially in North China, mothers and children being particularly affected. (4) Protein is insufficient because of a poor quality. (5) Vitamin deficiencies in some areas are serious, the intake of certain vitamins in many sections being sufficient to prevent specific diseases but definitely inadequate for good health.

The outstanding problems with regard to vitamins are the following: (1) A major lack of good sources of vitamin A. (2) A widespread deficiency in vitamin B<sub>1</sub> in the south, with few regions having an adequate supply. (3) Irregular deficiencies in vitamin C. Seasonal and current sources are not sufficient, perhaps more because of storage loss than of deficient production. This is most noticeable in North China

<sup>7</sup> BUCK, JOHN LOSSING, LAND UTILIZATION IN CHINA. 676 pp., illus. Chicago. 1937.

~~~

during the season when fresh vegetables are not available. (4) Deficiencies in vitamin D are the most outstanding, particularly among those people that have a limited exposure to sunshine, largely in North China. While the appearance of rickets is not widespread, there is much evidence of faulty calcium and phosphorus metabolism, with which vitamin D is connected.

Although, as already indicated, improvement in transportation and storage facilities will gradually eliminate many of the diet deficiencies and periodic famines formerly occurring in China, these improvements alone will not solve the whole problem. Much of the deficiency in the rural diet results also from a lack of diversification in local production, to faulty methods of preparation, to poor handling of food products, and to food habits that are frequently associated with ancient methods of production. In order to alter these, education and demonstration work will be required. Agricultural extension can assist in bringing about changes in crops, and nutritionists can encourage the proper use both of new products and of those to which the population have long been accustomed.

For factory workers in cities, better food can be provided under proper supervision from products available locally. With better marketing conditions permitting lower prices on products shipped in, the problem would be made still easier.

Many constructive steps to improve the dietary must wait for the introduction of general-improvement measures, but the following can be undertaken at the present economic level:

(1) An increased production of leafy vegetables to supply calcium and certain vitamins. (2) A wider use of certain roots, such as carrots and turnips, red sweet-potatoes, potatoes, tomatoes, and a much greater use of fruits. (3) Increases in the use of soybeans, and the introduction of other legumes. (4) A greater production of chickens, which are efficient converters of vegetable to animal protein; and a higher consumption of eggs, especially on the part of children, even if this means some reduction in exports. (5) Dairying near large centers of population, which can be moderately encouraged to provide milk for some of the people, especially for children.

Agricultural adjustments to bring about a substitution of leafy vegetables and fruits for grains would probably mean a large production of needed food per unit of land. A better distribution of labor throughout the year would also be obtained. These changes would improve the quality of the diet, lead to a better state of health, promote a greater productive efficiency, and permit of a better standard of living.

To provide milk, milk animals other than cows, such as the goat, may be increased in places. The extent to which the development of milk production is needed, however, will depend upon ability to secure during the post-war period dried and condensed milk from foreign sources at low prices.

Steps also need to be taken to correct the tendency to use highly milled products, such as white flour and polished rice. This means organization to make the freshly milled products available and to permit a proper storage of grain preparatory to milling.

Likewise, faulty nutrition during growth, which shows its effects in many parts of China, needs particular attention in any program for improvement of the dietary. To indicate corrections, more complete data are needed on diets in different parts of China. In addition, clinical data are needed to show the incidence of vitamin-deficiency diseases, since food-consumption data provide an uncertain basis for any conclusions as to the adequacy of vitamin intake.

# AGRICULTURE AND FOOD IN DENMARK . . . .

By Karen J. Friedmann\*

*Danish agriculture before the war was organized with a view to the most efficient production of animal foodstuffs, with large imports of oil cake and corn for feed. For reasons of quality, bread grains for human consumption were also largely imported. After the outbreak of war, these imports were discontinued. The domestic crops of wheat and rye normally fed to livestock constituted a reserve of bread grain sufficient to supply human requirements of farinaceous foods, but, with the reduction in feed supplies, livestock numbers declined. In the summer of 1942 an equilibrium was reached; domestic crops supplied food for the population and sufficient feed for livestock to permit substantial though greatly reduced exports. Thus, Denmark has been, and probably will continue, on a basis of food and feed self-sufficiency, with some export surpluses of animal foodstuffs.*

## DENMARK'S AGRICULTURE AND FOOD ECONOMY PRIOR TO WORLD WAR II

### Introduction

From the end of the last century and up until the present war, developments in Danish farming had resulted in a highly commercialized type of agriculture, which, for continued existence in its pre-war structure and volume, was dependent on imports of such raw materials as concentrates and fertilizers and on exports of livestock products. The particular use of the land and the crops was adjusted to this situation. Bread grains were grown, but most of the domestic production was normally used for feed; wheat and rye for human consumption were imported. The other domestic grains were also fed to livestock. Only a fraction of the acreage in root crops - perhaps one-seventh - served direct human consumption. The remaining agricultural area was used for the production of absolute feed.

### Crop Production

A total agricultural area of about 7,400,000 acres in 1933-37 (not including fallow land, some outlying fields, etc.) produced a total crop of 3,702,000 short tons of grain, of which only 660,000 tons were bread grains; 1,400,000 tons, potatoes; 1,500,000 tons, sugar beets; and 25,200,000 tons, roots for feed (table 1). In addition, 2,200,000 tons of hay and 5,000,000 tons of straw were harvested, and an estimated 2,700 million feed units<sup>1</sup> were obtained from grass and green feed.

These crops represent high yields per acre. Wheat and barley yielded crops which averaged close to 2,500 pounds per acre, oats yielded around 2,300, and rye 1,500 pounds. The yield of fodder roots averaged 25 short tons per acre as compared with 14.5 for sugar beets. The dry-matter content of the sugar beet is, however, much

\* Office of Foreign Agricultural Relations.

<sup>1</sup> A feed unit represents the feed value of 1 kilogram (2.2 pounds) of barley, and all crops are converted into this unit. They are, in other words, compared on the basis of their value as livestock feed.

higher than that of fodder roots (mangels, turnips, rutabagas); namely, 22 to 24 percent as compared to 12 to 14 percent. Potato yields averaged 7.5 short tons per acre. There are significant differences between Jutland and the islands in respect to potato yields. In 1937, for instance, the yield in Jutland was 7.6 short tons per acre; on the islands it was only 6.1. In other years the difference was even greater. A comparison between the yields per acre of grains and roots, on the basis of feed units, shows that roots in general provide twice as many feed units per acre as do grains (including the feed value of the straw).

These high yields do, however, involve a high input of labor, fertilizer, and animal draft power. Furthermore, while roots provide the main succulent cattle feed in wintertime, they must be consumed on the farm where they are produced. There is, therefore, no incentive for a farmer to increase his root production, except as his cattle numbers increase.

Production statistics for seeds are not available. Denmark is, however, self-sufficient in respect to seeds, with the exception of the seeds of some leguminous plants in the grass fields, such as lucerne, early clover, and kidneyvetch. There are, on the other hand, significant exports of root and grass seeds.

### Utilization of Crops

#### Feed

As already emphasized, the major part of the Danish crop is fed to livestock. (See tables 1 and 2.) About 83 percent of the wheat, rye, and barley production was fed to livestock, whereas the corresponding figures for oats and mixed grain were 90 and 88 percent, respectively, with the remaining 10 to 12 percent being mainly seed and waste.

Of the potato crop, 44 percent was fed. Fodder roots, hay, straw, grass, and green feed were, of course, used entirely as feed. No allowance has been made for waste in respect to coarse feed, which, in the case of roots, was probably considerable.

The average amount of feedstuffs available annually during the pre-war years from domestic as well as foreign sources averaged 11,279 million feed units (table 2). If the milk fed to pigs and calves is included, the total figure is 12 billion. Of this, home-grown coarse feed provided 7 billion, domestically produced concentrates 2.7 billion and imported concentrates 1.5 billion. The bulk of the imported feed was oil cake, of which the annual imports averaged 0.9 billion feed units; corn provided 0.4 billion, and grains and bran 0.2 billion. On the basis of their feed-unit value, the imported feedstuffs therefore do not appear to have been of great importance. On this basis, only 12.5 percent of all feed (including milk) was imported. The contribution of the imported feedstuffs to the protein fed to Danish livestock was, however, of much greater significance. Domestic feed is low in protein. This is particularly true of roots which supply only about 36 grams<sup>2</sup> of protein per feed unit, whereas the feed of a high-yielding dairy cow should contain around 125 grams of protein per feed unit. The protein deficit was therefore made up through the feeding of imported oil cake.

On the basis of protein content, imported feedstuffs provided about one-fourth of the total supply as compared with only one-eighth on a feed-unit basis. If measured against the protein content of cattle feed alone, the share contributed by imported feed may be estimated at about one-third. This is the more realistic comparison, since most of the imported oil cake is actually fed to dairy cattle. It means that

<sup>2</sup> 1 gram = 0.0353 ounce.

TABLE 1.—Acreage and production of specified crops and production of animal foodstuffs in Denmark, average 1933-37, annual 1939-43

ITEM	ACREAGE					PRODUCTION						
	AVERAGE 1933-37	1939	1940	1941	1942	1943	AVERAGE 1933-37	1939	1940	1941	1942	1943
	1,000 acres	1,000 acres	1,000 acres	1,000 acres	1,000 acres	1,000 acres	1,000 short tons	1,000 short tons	1,000 short tons	1,000 short tons	1,000 short tons	1,000 short tons
Wheat . . . . .	294	331	203	203	15	114	384	462	208	209	22	198
Rye . . . . .	358	339	343	474	469	558	278	266	300	342	452	551
Barley . . . . .	880	1,040	981	932	1,021	971	1,107	1,377	1,277	1,014	1,532	1,400
Oats . . . . .	934	929	857	845	835	810	1,077	1,114	1,000	794	1,102	1,147
Other grain . . . . .	823	759	813	810	929	791	856	774	794	639	1,047	981
Total grain . . . . .	3,289	3,398	3,197	3,264	3,269	3,244	3,702	3,993	3,579	2,998	4,155	4,277
Potatoes . . . . .	190	173	158	180	245	265	1,440	1,349	1,490	1,455	1,874	2,138
Sugar beets (sugar)	101	99	109	114	111	111	1,476	1,745	1,731	1,756	1,598	1,444
Roots for feed . . . . .	991	1,025	1,013	971	976	951	25,198	27,412	25,955	22,539	23,920	23,038
Total roots . . . . .	1,282	1,297	1,280	1,265	1,332	1,327	28,114	30,506	29,176	25,750	27,392	26,620
Meadows							2,215	1,750	1,552	992	937	2,326
Hay . . . . .	983	885	803	660	551	—	(1,5,002	5,215	4,413	4,299	4,238	—
Straw . . . . .							2,696	1,2,908	2,809	2,700	2,640	—
Grass & green feed	1,853	2,016	2,162	2,372	2,347	—	3,310	—	—	—	—	—
Milk, total . . . . .	—	—	—	—	—	—	5,821	5,782	5,087	3,975	3,671	4,3968
From imported feed	—	—	—	—	—	—	2,511	—	—	—	—	—
From domestic feed	—	—	—	—	—	—	3,310	—	—	—	—	—
Butter, total . . . . .	—	—	—	—	—	—	200	202	180	138	119	4,138
From imported feed	—	—	—	—	—	—	107	—	—	—	—	—
From domestic feed	—	—	—	—	—	—	93	—	—	—	—	—
Cheese, total . . . . .	—	—	—	—	—	—	32	36	37	30	36	4,36
From imported feed	—	—	—	—	—	—	—	—	—	—	—	—
From domestic feed	—	—	—	—	—	—	32	—	—	—	—	—
Eggs, total . . . . .	—	—	—	—	—	—	3 <sup>1</sup> 06	149	125	65	42	4,42
From imported feed	—	—	—	—	—	—	33	—	—	—	—	—
From domestic feed	—	—	—	—	—	—	73	—	—	—	—	—
Pork, total . . . . .	—	—	—	—	—	—	382	341	348	209	127	4,154
From imported feed	—	—	—	—	—	—	178	—	—	—	—	—
From domestic feed	—	—	—	—	—	—	204	—	—	—	—	—
Beef & veal, total	—	—	—	—	—	—	164	171	224	183	161	4,121
From imported feed	—	—	—	—	—	—	—	—	—	—	—	—
From domestic feed	—	—	—	—	—	—	164	—	—	—	—	—
Lard, total . . . . .	—	—	—	—	—	—	19	14	12	9	4 <sup>6</sup>	4 <sup>7</sup>
From imported feed	—	—	—	—	—	—	9	—	—	—	—	—
From domestic feed	—	—	—	—	—	—	10	—	—	—	—	—

<sup>1</sup> Million feed units.

<sup>2</sup> Intermediate product utilized in production of that 107,000 tons of butter, which is attributed to imported feed.

<sup>3</sup> There was a steady increase in the production of eggs during the period. See also footnote 3, page 115.

<sup>4</sup> Estimated.

Compiled by Office of Foreign Agricultural Relations, from official sources, or reports based on official statistics.

the large export surplus of butter was not altogether a genuine surplus but was directly dependent upon the importation of oil cake. Similarly, a considerable part of the exports of bacon and eggs was dependent upon imported corn.

#### Human Consumption

Of the total grain crop of 3,702,000 short tons, only 65,168 tons, or less than 2 percent, were used for direct human consumption (see footnote 2, table 3). Half of

TABLE 2.-Available feed in Denmark, average 1933-37

	DOMESTIC FEED	IMPORTED FEED	TOTAL FEED	DOMESTIC FEED	IMPORTED FEED	TOTAL FEED
CONCENTRATED FEEDS:	1,000 short tons	1,000 short tons	1,000 short tons	1,000 million units	1,000 million units	1,000 million units
Wheat . . . . .	319	99	418	289	90	379
Rye . . . . .	231	36	267	209	33	242
Barley . . . . .	920	(1)	920	835	—	835
Oats . . . . .	972	8	980	741	6	747
Mixed grains . . . . .	761	—	760	621	—	621
All grains . . . . .	3,203	143	3,345	2,695	129	2,824
Legumes . . . . .	8	—	8	7	—	7
Corn . . . . .	—	388	388	—	373	373
Bran . . . . .	9	296	105	7	70	77
Feed meal from grains . . . . .	2	13	15	2	12	14
Other feed meals . . . . .	—	3 19	19	—	4 17	17
Oil cake . . . . .	—	837	837	—	4 911	911
Total concentrated feeds . . . . .	—	—	—	2,711	1,512	4,223
COARSE FODDER:						
Potatoes for feed . . . . .	637	—	637	151	—	151
Feed roots . . . . .	25,199	—	25,199	2,396	—	2,396
Hay . . . . .	2,215	—	2,215	846	—	846
Straw . . . . .	5,002	—	5,002	967	—	967
Grass and green feed . . . . .	—	—	—	2,696	—	2,696
Total coarse fodder . . . . .	—	—	—	7,056	—	7,056
Total feed of vegetable origin . . . . .	—	—	—	9,766	1,513	11,279
Milk for feed (all types) . . . . .	—	—	—	820	—	820

<sup>1</sup> 31,077 tons of barley were exported.

<sup>2</sup> Imported as bran or produced from imported grain.

<sup>3</sup> 246 million of this produced domestically from imported oilseed.

<sup>4</sup> 228,000 tons produced domestically from imported oilseed.

Compiled by the Office of Foreign Agricultural Relations from official statistics.

this amount was wheat, so that approximately 8 percent of the wheat crop appears to have been used for human consumption. Less than 14,000 tons of domestic rye, or 5 percent of total production, were used for the production of rye flour.

In the pre-war utilization of the total supply of grains - domestic and imported - a total of 468,000 tons was used for the production of flour and groats, of which 403,000 tons were imported. Furthermore, 52,000 tons of domestic barley went into industrial uses (beer production). With milling percentages of 72.6 percent for wheat, 90 for rye, 65 for barley and 60 for oats, a total of 370,000 tons of flour and groats was produced. The production of wheat flour was of practically the same magnitude as that of rye flour; namely, 172,000 and 178,000 tons, respectively. There was, however, an average import of nearly 19,000 tons of wheat flour, whereas about 6,000 tons of rye flour were exported. Thus the total consumption of wheat flour was about 10 percent higher than that of rye flour. (See table 3.)

Total domestic production of legumes, which after deduction for seed and waste amounted to about 8,000 tons, was fed to livestock. Of an import of about 3,000 tons less than 2,000 were used for human consumption.

Of a total potato production of 1,400,000 tons, 330,000 tons were used for direct human consumption according to estimates by Danish authorities. In addition to this, the potato equivalent of the annual consumption of potato flour was 72,000 tons. In the first year of the period (1933), 6,000 tons of potato flour were imported, but since 1934 the Danish potato-flour industry has been able to cover total domestic consumption.

TABLE 3.—Pre-war balance of grain, legumes, potatoes, and sugar, average 1933-37

ITEM	WHEAT	RYE	BARLEY	OATS	MIXED GRAIN	CORN	RICE	TOTAL GRAIN	LEGUMES	POTATOES	SUGAR <sup>1</sup> (refined)
SUPPLY:	1,000 short tons										
Production . . . . .	382	278	1,107	1,078	848	—	—	3,693	8	1,440	200
Seed and waste . . . . .	-34	-33	-92	-96	-81	—	—	-336	-1	-353	—
Net production . . . . .	348	245	1,015	982	767	—	—	3,357	7	1,087	200
Net trade . . . . .	+307	+219	-31	+19	—	+392	—	+906	+3	-16	+4
Total supply . . . . .	655	464	984	1,001	767	392	—	4,263	10	1,071	204
UTILIZATION:											
Direct human consumption <sup>2</sup>	237	197	12	21	—	—	—	468	2	331	3 <sup>204</sup>
Other human consumption	—	—	52	—	—	—	—	52	—	72	—
Industrial consumption .	—	—	—	—	—	4	—	4	—	31	—
Feed . . . . .	418	267	920	980	767	388	—	3,740	8	637	—
Total consumption . . .	655	464	984	1,001	767	392	—	4,264	10	1,071	204
HUMAN CONSUMPTION OF GRAIN:											
Grain for flour . . . . .	237	197	12	21	—	—	—	468	—	—	—
Percentage of extraction	72.6	90	65	60	—	—	—	—	—	—	—
Flour equivalent . . . . .	172	178	8	12	—	—	—	370	—	—	—
Imported as flour, etc.	+19	-6	+2	+1	—	—	+12	28	—	—	—
Total human consumption <sup>4</sup>	191	172	10	13	—	—	12	398	—	—	—

<sup>1</sup> Total sugar-beet production was 1,901,180 tons (1933-37 average), of which 1,474,436 tons were used in sugar production and 426,744 were fed.

<sup>2</sup> Figures for grains represent grain or flour in terms of grain. Of this 29,872 tons of wheat, 13,889 of rye, 11,663 of barley, and 9,744 of oats, or a total of 65,168 tons, were of domestic origin.

<sup>3</sup> Including sugar used in industries, of which the ultimate products are domestically consumed.

<sup>4</sup> Grain and grain products in terms of flour.

Compiled by the Office of Foreign Agricultural Relations from official statistics.

Total sugar-beet production averaged 1,900,000 tons, of which an average of 1,500,000 tons was used for sugar production. This figure fluctuates greatly from year to year because of the variations in yields. Furthermore, the sugar content of the beets is subject to considerable variations. In some years, therefore, imports of sugar have been significant, whereas in other years there was an export surplus. On the average for the 5-year period 1933-37, there was an import of only 4,000 tons of refined sugar or refined-sugar equivalent of imported raw sugar. Domestic production of the refined product averaged 200,000 tons.

#### Livestock Numbers

The feed situation described in the preceding section provided the basis for a considerable livestock industry with emphasis on dairy cows and bacon pigs. The numbers of animals kept on Danish farms, according to the pre-war average figures for the 1933-37 period (table 5), conceal some significant developments. For instance, while the average number of pigs on farms was 3,413,000, there was a drop from 4,407,000 in 1933 to 3,061,000 in 1934. The hog figure had culminated in 1931 with 5,455,000, on the basis of which 7 to 8 million pigs were slaughtered annually, but severe reductions in the bacon quota granted Denmark by the British market brought about a drastic adjustment in the 1934 census figures.

While total cattle numbers stayed around 3,100,000 during the period, there was a significant reduction in the number of dairy cows, from 1,770,000 in 1933 to 1,574,000 in 1937, and a corresponding increase in the number of other cattle. The

~~~

TABLE 4. Numbers of livestock on farms in Denmark, according to July census

| TYPE                     | 1933-37   | 1939      | 1940      | 1941      | 1942      | 1943      |
|--------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Horses . . . . .         | Thousands | Thousands | Thousands | Thousands | Thousands | Thousands |
|                          | 1,523     | 594       | 594       | 539       | 596       | 2,600     |
| Cattle:                  |           |           |           |           |           |           |
| Dairy cows . . . . .     | 1,664     | 1,647     | 1,619     | 1,456     | 1,391     | —         |
| Other cattle . . . . .   | 1,428     | 1,684     | 1,660     | 1,548     | 1,474     | —         |
| Total . . . . .          | 3,092     | 3,326     | 3,279     | 3,004     | 2,865     | 2,980     |
| Hogs:                    |           |           |           |           |           |           |
| Boars . . . . .          | 22        | 18        | 17        | 11        | 9         | 9         |
| Sows . . . . .           | 395       | 390       | 336       | 240       | 172       | 231       |
| Suckling pigs . . . . .  | 823       | 856       | 761       | 440       | 253       | 429       |
| Other pigs . . . . .     | 3,213     | 1,919     | 2,104     | 1,079     | 772       | 1,342     |
| Total . . . . .          | 3,413     | 3,183     | 3,218     | 1,770     | 1,206     | 2,011     |
| Chickens:                |           |           |           |           |           |           |
| Hens . . . . .           | 12,136    | 13,530    | 13,731    | 6,850     | —         | —         |
| Other chickens . . . . . | 14,736    | 18,869    | 10,837    | 5,098     | —         | —         |
| Total . . . . .          | 26,872    | 32,399    | 24,568    | 11,948    | 11,478    | 14,000    |
| Sheep . . . . .          | 187       | 147       | —         | —         | 171       | 180       |

<sup>1</sup> The number of horses outside of rural districts was as follows: 1933, 19,000; 1939, 17,000; and in April 1941 it was estimated at at least 24,000.

<sup>2</sup> It is not definitely stated that this figure refers to horses on farms, but it seems likely.

<sup>3</sup> There was a drop from 4,407,000 in 1933 to 3,061,000 in 1934.

<sup>4</sup> Figure refers to 1937 only.

Office of Foreign Agricultural Relations; 1933 to 1940 official statistics; 1941-43 U. S. foreign-service reports, based on official Danish statistics.

number of horses underwent a slow but steady growth, and chicken figures reached a high of 28,600,000 in 1935, fell to 26,500,000 in 1937, and increased again to 32,400,000 in 1939. Sheep were not of much importance.

### Livestock Products

Danish export surpluses of butter, bacon, and eggs were largely dependent upon imported feed supplies. In order to evaluate this dependence in terms of the final product, an allocation of imported feedstuffs to the various types of livestock has been made, and the specific production resulting from this allocated imported feed was estimated. Obviously, such allocations are somewhat arbitrary and can be presented only with reservations. Nevertheless, they are believed to give a fair approximation to the actual relationship (table 1). Over half the butter production, or 107,000 tons, was attributed to foreign feed. This leaves a production from domestic resources of 93,000 tons, of which only 36,000 tons were domestically consumed (see table 6). The genuine export surpluses were also considerable in the case of pork and eggs. Total pork production was 382,000 tons, with 204,000 tons from purely domestic sources and a domestic consumption of only 129,000 tons. (See table 7.) Egg production totaled 106,000 tons, <sup>3</sup> production from domestic feed alone 73,000 tons, and domestic consumption only 22,000 tons.

With an average number of dairy cows of 1,664,000, total annual milk production came to 5,821,000 tons annually, or about 7,000 pounds per cow. (For the utilization of this milk, see the pre-war milk balance in table 5.) About 80 percent of the milk was used for the production of butter. Of the skim milk resulting from this production,

<sup>3</sup> Official Danish estimate. In view of later data, production at this time appears to have been underestimated by roughly 11,000 tons. Added to the original estimate, this would leave a domestic egg consumption of 33,000 tons.

TABLE 5.—Pre-war milk balance in Denmark, average 1933-37

| SUPPLY AND DISPOSITION | MILK          | BUTTER        | CHEESE        | CONDENSED MILK | FRESH MILK              |                       | FEED          |
|------------------------|---------------|---------------|---------------|----------------|-------------------------|-----------------------|---------------|
|                        |               |               |               |                | CONSUMPTION BY PRODUCER | CONSUMPTION BY OTHERS |               |
|                        | 1,000 sh.tons | 1,000 sh.tons | 1,000 sh.tons | 1,000 sh.tons  | 1,000 sh.tons           | 1,000 sh.tons         | 1,000 sh.tons |
| Production . . . . .   | 5,821         | —             | —             | —              | —                       | —                     | —             |
| Utilization of milk    | —             | 4,650         | 152           | 28             | 165                     | 551                   | 276           |
| Ultimate production .  | —             | 199           | 32            | —              | —                       | —                     | —             |
| Net trade . . . . .    | -3,860        | -163          | -9            | 3-28           | —                       | —                     | —             |
| Domestic utilization . | 1,961         | 36            | 23            | —              | 165                     | 551                   | 276           |
| Human consumption . .  | 1,685         | 36            | 23            | —              | 165                     | 551                   | —             |

<sup>1</sup> As per DANMARKS MEJERI-STATISTIK, 1933 to 1938 inclusive.

<sup>2</sup> In the production of this cheese was also used 200,800 tons skim milk and buttermilk.

<sup>3</sup> Fresh-milk equivalent.

<sup>4</sup> Fresh-milk equivalent of all dairy products.

Compiled by the Office of Foreign Agricultural Relations from official statistics; partly estimated.

a small part, 201,000 tons, was used in cheese production, and a similar amount is estimated to have been used for direct human consumption. By far the greater part, however, was utilized for the feeding of calves and pigs. In addition to the skim milk, 152,000 tons of whole milk were used in cheese production. Direct human consumption claimed 716,000 tons of fresh milk, and 276,000 tons of whole milk were fed to calves. A small amount, 28,000 tons, was used for the production of condensed milk, practically all of which was exported. Approximately 80 percent of the butter production and 30 percent of the cheese production were also exported. If these dairy products are converted into their milk equivalent, the result shows that 3,860,000 tons, or two-thirds of the milk produced, were exported. Of this, 2,511,000 tons, or 43 percent of total milk production, were produced from imported feed. Domestic human consumption claimed a total of 1,685,000 tons of milk, consumed as butter, cheese, and whole milk.

TABLE 6.—Pre-war balance of edible fats and oils in Denmark, average 1933-37

| ITEM                          | OLIVE   | OTHER VEGETABLE OILS | MARINE OILS | SLAUGHTER FATS | BUTTER   | ALL FATS AND OILS |
|-------------------------------|---------|----------------------|-------------|----------------|----------|-------------------|
|                               | Sh.tons | Sh.tons              | Sh.tons     | Sh.tons        | Sh.tons  | Sh.tons           |
| Domestic production . . . . . | —       | 144,054              | —           | 24,358         | 199,296  | 267,708           |
| Net trade . . . . .           | +52     | +2,476               | +15,730     | -14,908        | -162,596 | -159,246          |
| Net supply . . . . .          | 52      | 46,530               | 15,730      | 9,450          | 36,700   | 108,462           |
| Utilization:                  |         |                      |             |                |          |                   |
| For margarine . . . . .       | —       | 46,530               | 15,730      | 2,797          | —        | 65,057            |
| Other food uses . . . . .     | 52      | —                    | —           | 6,653          | 36,700   | 43,405            |
| Total utilization . . . . .   | 52      | 46,530               | 15,730      | 9,450          | 36,700   | 108,462           |

<sup>1</sup> Refined domestically or produced from imported oilseed.

Compiled by the Office of Foreign Agricultural Relations from official statistics.

Of a total fat consumption of 108,000 tons, butter contributed slightly more than a third. Vegetable oils provided 46,000 tons and whale oil 16,000 tons. Both these products were used in margarine production. Slaughter fats accounted for 9,500 tons. Of the hog fats, only lard is included in these figures; other hog fat is included in the pork figures. (See table 6.)

Of a total meat production of 610,000 tons, pork accounted for 382,000, beef and veal, 186,000 (see table 7). Exports totaled 310,000 or just about one-half. Exports

~~~

of live animals were converted into their slaughter-weight equivalent and included in these figures. The extent to which the export surplus of pork, as well as of eggs, is derived from imported feed has already been discussed. Domestic consumption of all meat amounted to 278,000 tons. The annual fish catch averaged 98,000 tons, of which 38,000 were exported. Total egg consumption averaged 22,000 tons annually.<sup>3</sup>

During the pre-war years of 1933-37 there was a surplus production of all livestock products: Milk, butter, cheese, meat, slaughter fats, and eggs. Fish was also on an export basis. Only one animal foodstuff was imported; namely, whale oil for the production of margarine (see table 6). A calculation on a calorie basis shows that production of animal foodstuffs from domestic resources (with production from imported feed left out of consideration) was over 200 percent of domestic consumption in the case of eggs, 250 percent in the case of butter, 160 percent for slaughter fats, 155 percent for meat and poultry and 140 percent for cheese. The genuine export surpluses of livestock products were thus considerable.

TABLE 7.-Pre-war balance of meat, fish, and eggs in Denmark, average 1933-37

ITEM	BEEF AND VEAL	PORK	LAMB AND MUTTON	POULTRY	OFFALS	TOTAL MEAT	FISH	EGGS
	Sh. tons	Sh. tons	Sh. tons	Sh. tons	Sh. tons	Sh. tons	Sh. tons	Sh. tons
Domestic production . . . . .	186,541	381,910	13,968	15,432	22,046	609,897	97,636	105,825
Net trade . . . . .	-47,016	-253,058	+323	-2,403	-8,091	-310,245	-37,533	-83,605
Total supply . . . . .	139,525	128,852	4,291	13,029	13,955	299,652	60,103	22,220
Industrial utilization . . . . .	21,825	—	—	—	—	21,825	—	—
Human consumption . . . . .	117,700	128,852	4,291	13,029	13,955	277,827	60,103	22,220

<sup>1</sup> Estimate for 1933 by Danish authorities.

<sup>2</sup> Estimate for 1933 by Danish authorities. Includes liver, hearts, kidneys, and pork tenderloin.

<sup>3</sup> For production of meat meal, bone meal, technical fat, etc.

Compiled by the Office of Foreign Agricultural Relations from official statistics.

## AGRICULTURAL DEVELOPMENTS SINCE THE OUTBREAK OF WAR

### Introduction

With the pre-war agricultural and food situation in mind, obviously war and occupation, with termination of overseas imports and dislocation of export markets, must necessarily have reduced total agricultural production. But under the specific circumstances - with a feed-grain production that could be directed into the channels of production for direct human consumption and a great surplus of animal foodstuffs - threats of over-all caloric deficiencies have not so far arisen.

The difficulties to be surmounted in the reorientation of agriculture in accordance with wartime conditions and aims were first and foremost those of substituting home-grown cereals for imports and curtailing livestock numbers, as a result of the twofold reduction in feed supplies (cessation of imports and diversion to food uses). Further problems developed in the course of time, such as shortages of manpower, draft power, fertilizers, insect sprays, and binder twine. Adverse weather conditions - particularly very low temperatures which, in the winter of 1941-42, resulted in such extensive winter kill of wheat that practically all the crop that was left had to be reserved for seed - were an additional source of difficulties encountered by Danish agriculture from the outbreak of the war until the summer of 1942.

<sup>3</sup> See footnote 3, page 115.

~~~  
Acreage, Yield, and Production

## Areas

The total acreage in grain has not undergone significant changes (see table 1). The acreage in wheat, however, has fluctuated greatly under the influence of adverse weather conditions, decreasing from 331,000 acres in 1939 to 203,000 in 1940. Following the severe winter of 1941-42, the acreage of wheat harvested in 1942 dwindled to only 15,000 acres but, in 1943, increased to 114,000 acres. The rye acreage, on the other hand, underwent a fairly steady increase, so that it is now 55 percent greater than in 1933-37.

A large increase has also taken place in the acreage devoted to potatoes. First, there was a decline from 190,000 acres in 1933-37 to 158,000 in 1940, but 1942 showed an increase to 245,000 acres. The acreage for 1943 was given at 265,000 acres.

The sugar-beet acreage is reported to have been the same in 1943 as in the preceding war years, although a decline was anticipated due to an expected labor shortage in the sugar-beet season, unsatisfactory sugar prices, and a shortage of seed. The small decrease in the fodder-beet acreage is probably due to the fact that cattle numbers have decreased so that only a smaller root crop can be utilized.

There has been a pronounced decline in the acreage in hay; namely, from 983,000 acres before the war to 551,000 in 1942, but a more than corresponding increase in land under grass and green forage. Figures for 1943 are not yet available.

## Yields and Production

The yields of all grains were exceedingly low in 1941, and the total grain crop in that year was only 2,998,000 short tons or almost 20 percent below the average grain crop of 1933-37. But in 1942 good yields brought the crop up to 4,155,000 tons or more than 12 percent above the pre-war average. The 1943 yields were fully up to those of 1942, and the total grain crop came to 4,277,000 tons. The exceptionally high yield of 1.7 short tons of wheat per acre may be due to the fact, with a smaller-than-normal acreage in wheat, only the soils particularly well suited for wheat growing were used for this crop. Practically all the wheat and rye grown during the war, plus 170,000 tons annually of barley and oats have been used for human consumption. In 1942-43 larger quantities of barley, furthermore, had to be substituted for wheat as a bread grain.

The potato crop remained around 1,400,000 tons until 1942, when the large increase in the potato acreage raised production to 1,874,000 tons. The 1943 potato crop climbed to 2,138,000 tons.

The sugar-beet crop was very large in 1939, 1940, and 1941 (table 1), with a total of around 1,740,000 tons. But in 1942 it amounted to only 1,598,000 tons. Furthermore, the sugar content of the beets was lower than in 1941. Sugar-beet production in 1943 declined further to 1,444,000 tons and is expected to yield 214,000 tons of raw sugar. The fodder-beet crop underwent a slow decline as the acreage in this crop was diminished.

While the hay crop has declined in keeping with the reduction in acreage, there has not been any increase in the amount of feed units obtained from grass and green forage. This may be due in part to the fact that drought has had a deteriorating effect on pastures and perhaps in part to the method by which the feed from pasture is evaluated, since it is estimated on the basis of the number of livestock that have been grazing. With a considerable reduction in cattle numbers, the estimated amount of feed from pasture would also go down.

### Livestock Numbers and Production of Animal Foodstuffs

The lack of imported feedstuffs after the occupation led to immediate reductions in livestock numbers, with the exception of horses and sheep. Cattle numbers, which in 1939 totaled 3,326,000, had fallen to 3,004,000 in 1941 and declined further to 2,865,000 in 1942. (See table 4.) The number of dairy cows declined somewhat more sharply (15 percent) than that of other cattle (12 percent). The census of July 1943 shows an increase for all cattle to 2,980,000. The distribution of this number as between dairy cows and other cattle is not given.

The reduction in hogs, which in July 1940 numbered 3,218,000, was much more drastic. In May 1942 hog numbers reached a low of 1,162,000; by July they were 1,206,000, a reduction of over 62 percent from the total of July 1940. Better crops in 1942, both of grains and potatoes, provided a basis for increased breeding of hogs, and by the summer of 1943 the figure had again passed 2,000,000. In January 1944 it stood at 2,291,000. This, however, is still about one-fourth below pre-war figures. Further sustained increase in hog numbers is improbable; experts insist that numbers have been getting too high for domestic feed supplies.

Farmers have been urged to increase sheep breeding, mainly to provide wool. As a result, there has been an expansion of over 20 percent, compared with the 1939 figure of 147,000, which seems very low, however, since sheep numbers in 1937 were reported to have totaled 187,000.

Numbers of chickens declined from a total of slightly over 32,000,000 in 1939 to 11,500,000 in 1942. They increased to 14,000,000 in 1943. There has been a great increase in the number of rabbits.

The production of animal foodstuffs has fluctuated greatly, as a result of this movement in livestock numbers (see table 1). Total milk production fell from 5,821,000 short tons before the war to 3,671,000 tons in 1942 or by 37 percent. Since the decline in the number of milk cows was only 15 percent, the decline in milk yields per cow must have been about one-fourth. If the number of cows at the census in July 1942 represents cow numbers during the year, we get an average milk production per cow of not quite 5,300 pounds as compared with the pre-war average yield of 7,000 pounds.

Butter production claimed around 2,646,000 tons of milk in 1942 or about 72 percent of total milk production. The resulting production was 119,000 tons of butter as compared with 200,000 tons in 1933-37. Cheese production, on the other hand, remained at about the pre-war level, although the fat content of cheese has been considerably reduced. Consumption of whole milk is stated to have increased somewhat.

Better feed supplies, including improved grazing in the summer of 1943, and a slow increase this year in cow numbers have resulted in an increase in milk production. Total production for 1943 has been roughly estimated at 3,968,000 tons. Butter production also increased during the summer months, although the first 3 months of the year showed a lower production than in 1942. For the whole year, it has been estimated at 138,000 tons.

Danish authorities have estimated that an annual production of 154,000 tons of pork may be expected when the pig population reaches 2,000,000. This was the case in 1943. In 1942 production was down to 127,000 tons or only one-third of average pre-war production.

Beef and veal production is reported to have been considerably lower in 1943 than in 1942, owing to the better feed situation and the farmers' desire to expand reduced cattle numbers. Total production in 1943 may not have been much above 100,000 tons.

### Food Supplies

By and large, food supplies in Denmark have remained good as compared with those of other occupied countries. Domestic grains have been substituted for imports in the production of flour and groats; potato production has been stepped up, and an increased amount of this crop has been used for direct human consumption. Sugar production has been large enough for the population to have been supplied with sugar in pre-war quantities. Actually, however, sugar was rationed immediately after the outbreak of war and consumption reduced to something like three-fourths of normal, in order to assure an export surplus in return for which much-needed imports, particularly of wood and wood products, could be obtained from the other Scandinavian countries. Vegetable and fruit supplies, with the exception of imported citrus fruit and bananas, appear to have been satisfactory. Supplies of vegetable oils, however, have been practically nil, and margarine production has been suspended.

While production of animal foodstuffs has been greatly curtailed, there would still have been enough for a domestic consumption of pre-war magnitude if nothing had been exported. German claims have, however, resulted in such large exports that total meat consumption is less than two-thirds of what it was before the war. Although one-third to two-fifths of the present reduced butter production is exported, domestic butter consumption is twice as large as before the war. Because of lack of margarine, however, total consumption of fats and oil is only about two-thirds of its usual magnitude. There is not much change in egg or cheese consumption, and consumption of fresh milk is stated to be slightly larger than in pre-war years. There appears to have been a general over-all reduction in the daily caloric intake by about 11 percent.

Exports of agricultural products are most significant in respect to butter and meats. Sugar exports are also sizable, and exports of cheese and eggs only come to smaller amounts. The fish catch was greater in 1941 and 1942 than in pre-war years, but a large part of the increase is supposed to have been exported. There have been practically no imports of foodstuffs into Denmark during the occupation.

Only comparatively few agricultural products are subject to rationing - primarily breadstuffs, sugar, and butter. Meat sales are also regulated, though meat is not actually rationed; and, in the case of fresh milk for consumption, there appear to have been local regulatory measures at times.

Judging by the 1943 crop returns, there seems to be no prospect of drastic changes in the total food production of Denmark during the crop year 1943-44. The production of vegetal and animal products has arrived at an equilibrium where domestic production and consumption are independent of any imports of food or feedstuffs, although imported fertilizers still contribute to these results. The upward trend in hog numbers and, to a much smaller extent, in cattle numbers may not continue, but there does not appear to be reason to expect a reversion of the trend if the Danish Government and Danish farmers remain comparatively free to carry out their agricultural programs.

This does not mean that actual consumption by the Danish population in 1943-44 necessarily will be on the same level as in 1942-43. Greater concentration of German troops in Denmark and more ruthless requisitioning may reduce average per capita consumption by the Danish population even in case productive capacity remains at the 1942-43 level. Another possibility is that excessive German demands, say for beef and pork, may be enforced regardless of consequences as to future production. But at the present time, the productive capacity of Danish agriculture is still sufficiently intact to permit a return to the former high level of efficiency in the livestock industry within a few years after the resumption of world trade.